

MANUFACTURE OF OPTICAL FILM, OPTICAL FILM AND LIQUID CRYSTAL DISPLAY

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Abstract of JP2000190385

PROBLEM TO BE SOLVED: To manufacture a biaxial optical film in which control of a refractive index distribution is easy and the uniformity is high by setting a solution of a film forming material on the base plate, forming an optically negative uniaxial film being dried and oriented in its face, and stretching this film into biaxial film. **SOLUTION:** An optically negative uniaxial film is formed by disposing a solution of film making material on a base plate to subsequently be dried and oriented in its face. At this time, for such a base plate, there is employed an oriented film such as a plastic film having an appropriate thickness. Also, a film thickness of the negative uniaxial film is made relatively small with respect to a thickness of the base plate. The negative uniaxial film is stretched so as to form a biaxial film. This operation is conducted such that the negative uniaxial film is heated with a stretched film as a base plate. By this process, an optical film can be manufactured which has a high uniformity, an easy control of a refractive index distribution and the high quality, and demonstrates an excellent function.

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[Claims]

[Claim 1]

A method for manufacturing an optical film, comprising the steps of: disposing a solution of film making material on a base plate to subsequently being dried and oriented in its face to form an optically negative uniaxial film; and stretching the negative uniaxial film to form a biaxial film.

[Claim 2]

The method for manufacturing the optical film according to claim 1, wherein the base plate is a stretched film.

[Claim 3]

The method for manufacturing the optical film according to claim 2, wherein the negative uniaxial film is stretched with the stretched film while being heated in the step of stretching the negative uniaxial film.

[Claim 4]

An optical film obtained by the method according to any one of

claims 1 to 3.

[Claim 5]

The optical film according to claim 4, wherein distribution in a projection direction of a film optical axis to the film face is within $\pm 2^\circ$.

[Claim 6]

A liquid crystal display element comprising the optical film according to claim 4 or 5.

[0073]

When the negative uniaxial film is stretched with the stretched film, the stretched film as a base plate can be removed if necessary after the stretching step. If there is no problem in using a product, the stretched film can be also left.

[0075]

The second base plate used for transferring is not particularly limited as long as the second base plate has an adequate flatness. Glass and a transparent plastic film having optical isotropy or the like are preferable. Examples of the plastic films include films of polymethacrylate, polystyrene, polycarbonate, polyether sulfone, polyphenylene sulfide, polyarylate, amorphous polyolefin, triacetyl cellulose and an epoxy resin or the like. In particular, polymethyl methacrylate, polycarbonate, polyarylate, triacetyl cellulose and polyether sulfone or the like are preferably used. When an optically anisotropic base plate is required for applications of the purpose, the base plate can also be used as the second base plate. Examples of the optically anisotropic second base plate include

a retardation film and polarizing film obtained by stretching plastic films of polycarbonate and polystyrene or the like.

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(54)【発明の名称】 光学フィルムの製造法、光学フィルム及び液晶表示装置

(57)【要約】

【課題】屈折率分布の制御が容易でかつ均一性の高い二軸性の光学フィルムを製造する方法、容易に製造することができ屈折率分布が正確に所望の値に制御され均一性の高い光学フィルム、並びに透過光の屈折率が正確に制御され性能が高く容易に製造しうる液晶表示装置を提供する。

【解決手段】成膜材料溶液を基板上に配し、乾燥させて面配向した光学的に負の一軸性フィルムを得る工程、及びそれを延伸して二軸性フィルムとする工程を含む光学フィルムの製造法、それにより得られる光学フィルム、並びに前記光学フィルムを含む液晶表示素子。

【特許請求の範囲】

【請求項1】成膜材料溶液を基板上に配し、乾燥させて面配向した光学的に負の一軸性フィルムを得る工程、及び前記負の一軸性フィルムを延伸して二軸性フィルムとする工程を含むことを特徴とする光学フィルムの製造法。

【請求項2】前記基板が延伸フィルムであることを特徴とする請求項1記載の光学フィルムの製造法。

【請求項3】前記負の一軸性フィルムを延伸する工程において、前記負の一軸性フィルムを前記延伸フィルムと共に、加熱しつつ延伸することを特徴とする請求項2記載の光学フィルムの製造法。

【請求項4】請求項1～3のいずれか1項記載の製造法により得られる光学フィルム。

【請求項5】フィルム光軸のフィルム面への投影方向の分布が±2°以内であることを特徴とする請求項4記載の光学フィルム。

【請求項6】請求項4又は5記載の光学フィルムを含むことを特徴とする液晶表示素子。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は位相差フィルム、偏光フィルム等各種光学フィルムとして好適な二軸性の光学フィルム及びそれらの製造法、並びにこの光学フィルムを含む液晶表示装置に関する。

【0002】

【従来の技術】三次元の屈折率を制御した二軸性のフィルムは、偏光を利用する光学分野において有用である。特に液晶ディスプレーの分野では偏光をきめ細かく制御できるこのようなフィルムの重要性は高い。

【0003】現在工業的に利用できる複屈折性の光学フィルムの多くは一軸性の屈折率構造を有している。軸性が正のものや負のもの、また光軸がフィルム面内にあるものやフィルム法線方向にあるもの等がある。例えばSTN (Super Twisted Nematic) 液晶ディスプレーに用いられている色補償フィルムは光軸を面内に有する正の一軸性フィルムである。また、例えばHarrisらは特定のポリマーの溶液を基板上で乾燥させポリマーを面配向させることにより光軸をフィルム法線方向に有する負の一軸性構造を得ている(米国特許明細書第5344916号、第6480964号及び第5580950号)。この製造法は、光学フィルムの簡便な製造法として注目に値する。しかし、高い対称性を持つ一軸性の光学フィルムでは、その偏光の制御等における効果にはおのずと限界がある。

【0004】一方、二軸性のフィルムは、ポリマーフィルムの二軸延伸により作製することが可能であり、これについての多数の報告がある。しかしながら得られるフィルムの品質には問題がある。すなわち二方向の延伸のバランスにより三方向の屈折率構造を制御するため屈折

率制御が難しく、また得られたフィルムは面内で屈折率構造の分布ができやすく均一なフィルムを得るのが難しい。

【0005】このように二軸性フィルムは、工業的に生産する上で大きな課題が残されている。

【0006】

【発明が解決しようとしている課題】本発明の目的は、屈折率分布の制御が容易でかつ均一性の高い二軸性の光学フィルムを製造する方法を提供することにある。

【0007】本発明の別の目的は、容易に製造することができ、屈折率分布が正確に所望の値に制御され、均一性の高い光学フィルムを提供することにある。

【0008】本発明の別の目的は、透過光の屈折率が正確に制御され、性能が高く、容易に製造しうる液晶表示装置を提供することにある。

【0009】

【課題を解決するための手段】本発明者らは、二軸構造を得る方法として、延伸のみに頼らず、異なる2つの手法を段階的に用いることを考え、それに基づき許細な検討を行った結果、ついに本発明に到達した。

【0010】すなわち本発明によれば、成膜材料溶液を基板上に配し、乾燥させて面配向した光学的に負の一軸性フィルムを得る工程、及び前記負の一軸性フィルムを延伸して二軸性フィルムとする工程を含むことを特徴とする光学フィルムの製造法が提供される。

【0011】また、本発明によれば、前記基板が延伸フィルムであることを特徴とする前記光学フィルムの製造法が提供される。

【0012】

さらに、本発明によれば、前記負の一軸性フィルムを延伸する工程において、前記負の一軸性フィルムを前記延伸フィルムと共に、加熱しつつ延伸することを特徴とする前記光学フィルムの製造法が提供される。

【0013】さらに、本発明によれば、前記製造法により得られる光学フィルムが提供される。

【0014】さらに、本発明によれば、フィルム光軸のフィルム面への投影方向の分布が±2°以内であることを特徴とする前記光学フィルムが提供される。

【0015】

さらに、本発明によれば、前記光学フィルムを含むことを特徴とする液晶表示素子が提供される。

【0016】

【発明の実施の形態】本発明の方法は、光学フィルムを製造する方法であり、特に $n_y > n_x > n_z$ の屈折率構造を有する二軸性の光学フィルムを製造する方法である。本明細書においては、 n_x 、 n_y 及び n_z はそれぞれ、 x 方向、 y 方向及び z 方向の3方向の主屈折率であり、 x 方向と y 方向とは互いに直交するフィルム面内の方向であり、 z 方向はフィルムの膜厚方向とする。

【0017】本発明の方法では、屈折率を制御しながらフィルムを形成する2段階の工程、即ち、成膜材料溶液

を基板上に配し、乾燥させて面配向した光学的に負の一軸性フィルムを得る工程（以下、第1工程という。）、及び前記負の一軸性フィルムを延伸して二軸性フィルムとする工程（以下、第2工程という。）を含む。

〔0018〕第1工程に用いる前記基板としては、特に限定されずプラスチックフィルム等のプラスチック基板、ガラス板又は金属板等を用いることができる。基板として適當な厚みを有するプラスチックフィルム等の延伸フィルムを用いると、第2工程において負の一軸性フィルムと基板とを共に延伸することができるため、特に好ましい。

〔0019〕前記プラスチックフィルムとしては、キャスト法で作られたもの、又はポリマーの溶融状態を経て成膜した後、延伸操作を施したもの等を挙げることができるが、後者が特に好ましい。これは後者のフィルムの方が、第2の延伸工程において基板がある程度の強度を発現することにより、より精密な負の一軸フィルムの変形が行えるためである。

【0020】前記プラスチックフィルムとしては、ポリエチレンやポリプロピレン等のポリオレフィン、ポリイミド、ポリアミドイミド、ポリアミド、ポリエーテルイミド、ポリエーテルエーテルケトン、ポリエーテルケトン、ポリケトンサルファイド、ポリエーテルスルフォン、ポリスルフォン、ポリフェニレンサルファイド、ポリフェニレンオキサイド、ポリエチレンテレフタレート、ポリブチレンテレフタレート、ポリエチレンナフタレート、ポリアセタール、ポリカーボネート、ポリアリレート、アクリル樹脂、ポリビニルアルコール、ポリブロピレン、セルロース系プラスチックス、エポキシ樹脂、フェノール樹脂等のフィルムを挙げができる。中でも、ポリエチレン、ポリプロピレン、ポリエチレンテレフタレート、ポリエチレンナフタレート、セルロース系プラスチック等が特に好ましい。また、これらのプラスチックフィルムに、親水化処理や疎水化処理等の表面処理を施したもの用いることもできる。

【0021】前記プラスチックフィルムの厚みは、通常20μm以上200μm以下とすることができ、好みくは30μm以上150μm以上、特に好みくは60μm以上100μm以下である。20μmより薄い場合はフィルムの強度が弱いために第2工程において前記負の一軸性フィルムと共に延伸した場合に延伸むらが生じるおそれがあるため好みくない。200μm以上の場合は延伸において必要な張力が大きくなりすぎ工業生産には適さないおそれがあるため好みくない。

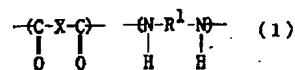
10 【0022】前記成膜材料溶液としては、各種のポリマーや重合可能な低分子化合物等の成膜材料を含む溶液を用いることができる。十分に大きい複屈折性を得るためには、すなわち $n_x - n_z$ が十分に大きい負の一軸性フィルムを得るためには、少なくとも 1 種類以上の芳香族環を持つ成膜材料を含むものが好ましい。

【0023】前記成膜材料としては、具体的には例えば、少なくとも1種類以上の芳香族環を有するポリアミド、ポリイミド、ポリアミック酸、ポリエステルあるいはポリエステルアミド等の各種のポリマー、又はこれらのポリマーを与える重合可能な低分子化合物を挙げることができる。これらは単独で用いても良いし、混合して用いても良い。

【0024】前記ポリアミドとしては、例えば下記式(1)で表わされる重合単位を含むポリマーが挙げられる。

{00251}

【化1】



30

【0026】式中X及びR¹は、任意の残基であって、少なくとも一方が芳香環を含む基である。

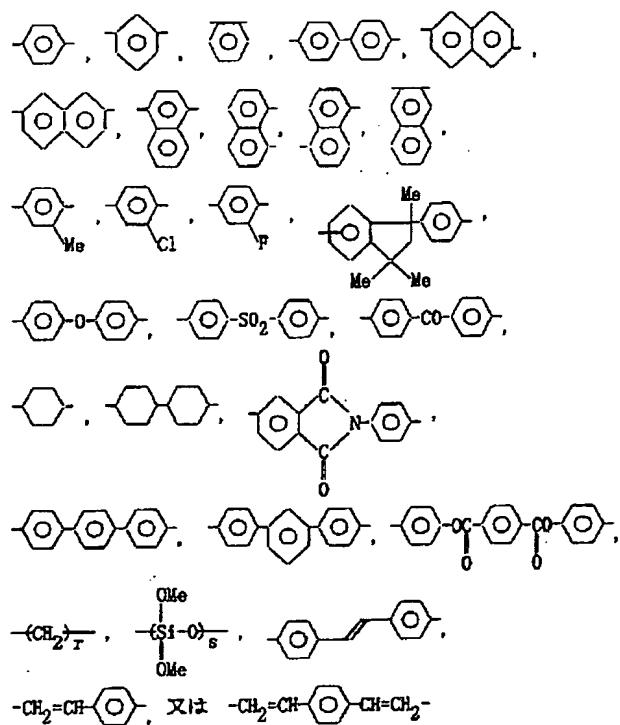
【0027】前記Xは、

[0028]

【化2】

5

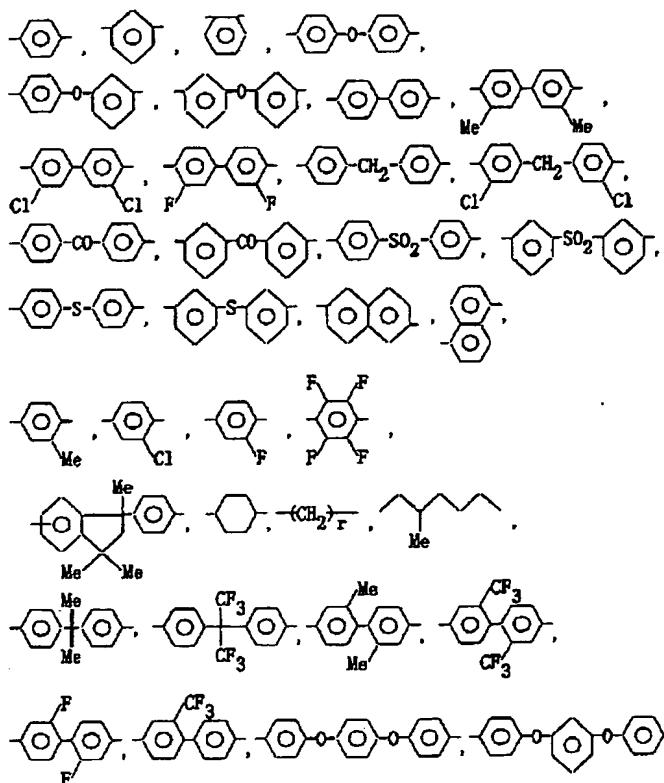
6



【0029】等の基であることが好ましく、R¹は、 *【化3】

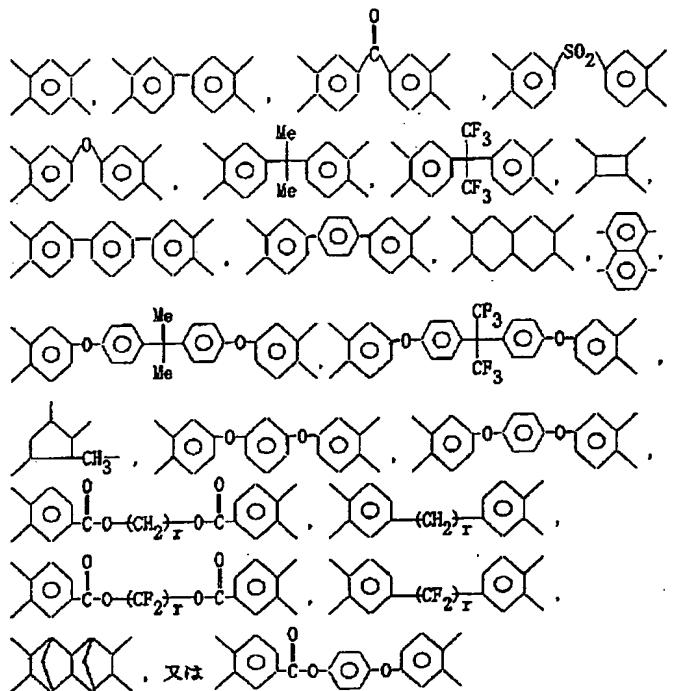
{0030}

*

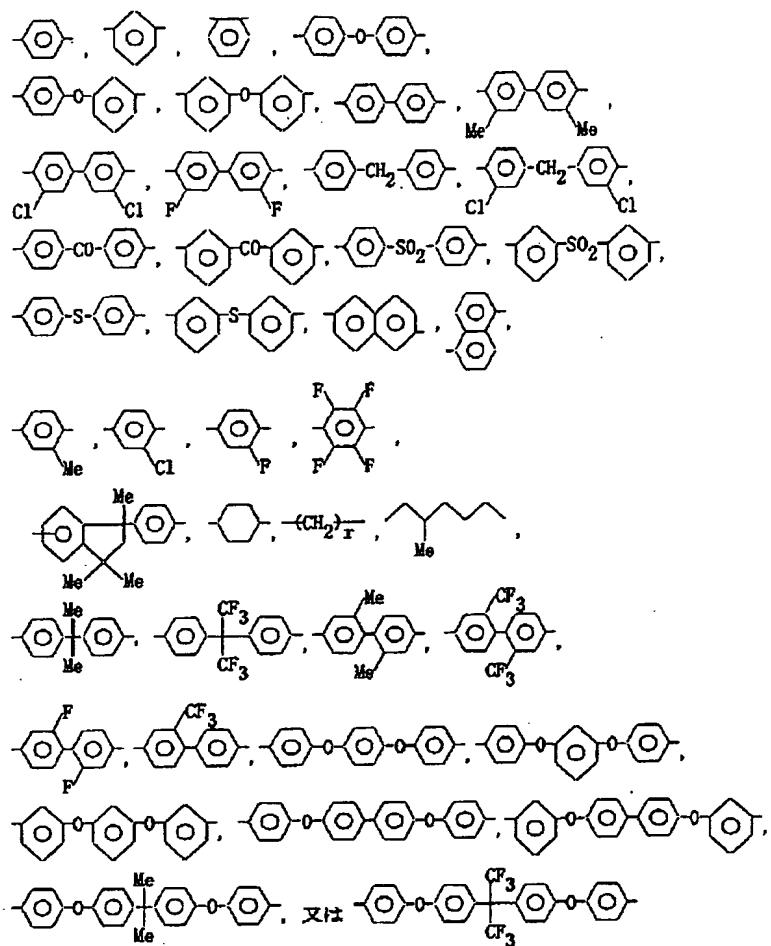


[0031]

〔化4〕



【0046】等の基を示し、R²は、
【0047】



【0048】等の基を示す。)を挙げることができ、より具体的には、下記式(7)~(9)で示されるポリマーを挙げることができる。

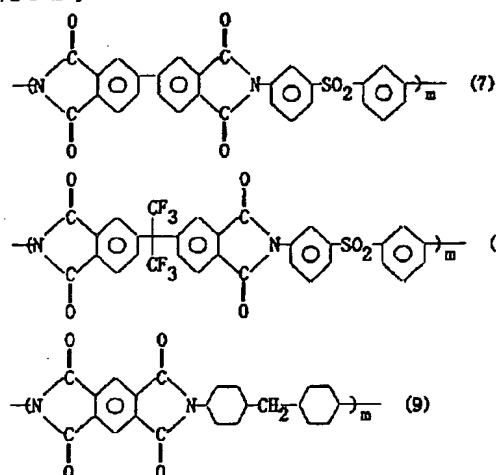
ができる。

り具体的には、下記式(7)～(9)で示されるボリマー 30 (0051)

[化 13]

[0049]

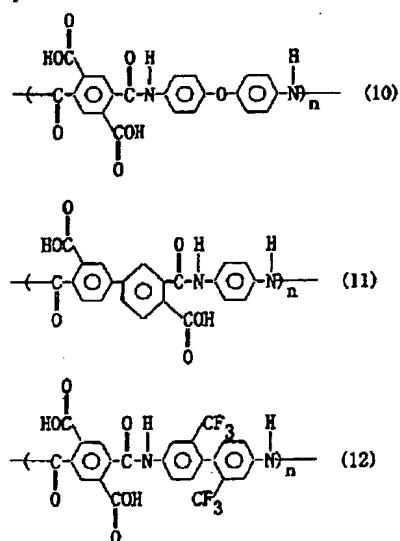
[化121]



【0050】前記ポリアミック酸としては、例えば下記式(10)～(12)で示されるポリマーを挙げること

〔0052〕(式中nは2～400の数を示す。)

50 なお、前記ポリアミック酸を用いる場合、溶液塗布、乾



40

燥した後、そのまま第2工程を行うこともできるが、熱処理によりイミド化した後、第2工程に供することもできる。

【0053】前記成膜材料溶液中の前記成膜材料の濃度は、通常0.5重量%以上40重量%以下、好ましくは1重量%以上30重量%以下、さらに好ましくは2重量%以上20重量%以下とすることができる。

【0054】前記成膜材料溶液において、前記成膜材料を溶解させる溶媒としては、前記成膜材料を溶解でき、かつ基板フィルムを極度には浸食しないものであればよく、使用する成膜材料及び基板に応じ適宜選択することができる。具体的には例えば、クロロホルム、ジクロロメタン、四塩化炭素、ジクロロエタン、テトラクロロエタン、トリトリクロロエチレン、テトラクロロエチレン、クロロベンゼン、オルソジクロロベンゼン等のハロゲン化炭化水素類、フェノール、パラクロロフェノール等のフェノール類、ベンゼン、トルエン、キシレン、メトキシベンゼン、1,2-ジメトキシベンゼン等の芳香族炭化水素類、アセトン、酢酸エチル、t-ブチルアルコール、グリセリン、エチレングリコール、トリエチレングリコール、エチレングリコールモノメチルエーテル、ジエチレングリコールジメチルエーテル、プロピレングリコール、ジプロピレングリコール、2-メチル-2,4-ベンタンジオール、エチルセルソルブ、ブチセルソルブ、2-ビロリドン、N-メチル-2-ビロリドン、ビリジン、トリエチルアミン、ジメチルホルムアミド、ジメチルアセトアミド、アセトニトリル、ブチロニトリル、二硫化炭素等及びこれらの混合溶媒等が用いられる。また、用いる成膜材料によっては硫酸も使用できる。

【0055】前記成膜材料溶液は、前記成膜材料及び溶媒に加えて、目的に応じ界面活性剤等の他の添加物を加えても良い。

【0056】前記第1工程において、前記成膜材料溶液を前記基板上に配する方法は、特に限定されず、スピンドルコート法、ロールコート法、ダイコート法等により行うことができる。これら的方法により前記成膜材料溶液を、得られるフィルムが所望の膜厚になるように基板上に配した後、乾燥させることにより負の一軸性フィルムを得ることができる。乾燥温度は溶媒の種類等に応じて適宜選択することができるが、通常40°C以上250°C以下、好ましくは50°C以上200°C以下とすることができる。乾燥は一定温度下で行っても良いし段階的に温度を上昇させて行っても良い。乾燥時間は通常10秒間以上30分間以下、好ましくは30秒間以上20分間以下、さらに好ましくは2分間以上15分間以下とすることができます。

【0057】前記成膜材料として前記各種のポリマーを用いた場合、成膜材料溶液を基板上に配し、乾燥させることでポリマーが面配向（乾燥時に溶剤を含む塗膜が膜

厚方向に収縮するため分子配向に異方性が生じる現象）した負の一軸性フィルムとすることができますが、前記成膜材料として重合可能な低分子化合物を用いた場合は、成膜材料溶液を基板上に配し、乾燥させて低分子化合物の面配向物を得た後、必要に応じ熱や光により架橋することにより、負の一軸性フィルムとすることができます。

【0058】前記負の一軸性フィルムとは、主屈折率 n_x 及び n_y がほぼ同一であり、且つ n_z より大きい関係を満たすフィルムをいう。具体的には n_x と n_y との差は0.001以下程度であれば、負の一軸性を有するものとして用いることができる。

【0059】主屈折率 n_x 、 n_y 及び n_z の値は、前記第1工程に従ってフィルムを作成した場合、通常用いる材料及び作製する条件に依存しては決まつてくる値であり、目的に応じて膜厚を選択して、光学的に重要なバラメータである面内と厚み方向のリターデーション値（ $(n_x - n_z)$ と膜厚 d の積で得られる値）を制御することができる。

【0060】前記負の一軸性フィルムにおいては、面内方向の屈折率と厚み方向の屈折率との差、すなわち $n_x - n_z$ は、ある程度大きいことが好ましく、通常0.02以上、好ましくは0.005以上、さらに好ましくは0.01以上、特に好ましくは0.02以上とすることが望ましい。該屈折率差が小さい場合は、面内と厚み方向に関する所望のリターデーションを得るために、フィルムの膜厚を厚くしなければならない。後で述べるように該膜厚が厚すぎる場合は延伸工程において均一な構造が得られにくくなるため、 $n_x - n_z$ の値は0.002以上であることが好ましい。

【0061】前記負の一軸性フィルムの厚み方向のリターデーション値、即ち $(n_x - n_z) \times d$ で与えられる値は通常20nm以上2000nm以下、より好ましくは50nm以上1000nm以下、さらに好ましくは100nm以上600nm以下とすることができます。20nm未満の場合はリターデーション値が小さすぎて、光学素子としての機能に欠けるおそれがあるため好ましくない。2000nmを超える場合は塗布や乾燥時にむらができ不均一なフィルムを与えるおそれがあるのであまり好ましくない。また、前記負の一軸性フィルムの膜厚は、通常0.2μm以上100μm以下、好ましくは0.5μm以上50μm以下、さらに好ましくは1μm以上20μm以下とすることができます。0.2μm未満の場合は、フィルムの複屈折値 $(n_x - n_z)$ にもよるが、概してリターデーション値が小さくなるため、光学素子としての機能に欠けるおそれがあるため好ましくない。100μmを超える場合は塗布や乾燥時にむらができ不均一なフィルムを与えるおそれがあるため好ましくない。

【0062】また、前記負の一軸性フィルムの膜厚は、後の第2工程において前記負の一軸性フィルムを前記基

板と共に延伸する場合、前記基板の膜厚よりも小さいことが好ましく、前記基板の膜厚の半分よりも小さいことがさらに好ましい。前記基板の膜厚に対して前記負の一軸性フィルムの膜厚を相対的に小さくすることにより、これらと共に延伸した際に均一な延伸を行うことができる。

【0063】本発明の方法は、前記第1工程に続いて、前記負の一軸性フィルムを延伸して二軸性フィルムとする第2工程を含む。

【0064】前記延伸は、前記基板としてガラス板又は金属板を用いた場合、第1工程により得られた負の一軸性フィルムを基板から剥離してから行うことができる。一方、前記基板として適当な厚みを有するプラスチックフィルム等の延伸フィルムを用いた場合、前記負の一軸性フィルムを、基板から剥離することなく、基板と共に延伸することができる。

【0065】前記負の一軸性フィルムを前記延伸フィルムと共に延伸すると、前記基板に張力が課せられ、前記基板が均一に延伸し、この均一な延伸に伴い前記負の一軸性フィルムが間接的に延伸されるので、前記負の一軸性フィルムを単独で延伸した場合等に比べて均一な延伸を行うことができるので好ましい。特に、前記基板の膜厚に対して前記負の一軸性フィルムの膜厚を相対的に小さくしてこれらと共に延伸すると、前記基板に主に張力が課せられ、均一な延伸が可能となるため特に好ましい。

【0066】前記延伸は、前記負の一軸性フィルムを、基板としての前記延伸フィルムと共に、加熱しつつ行うことが好ましい。加熱温度は、基材のガラス転移点以上、融点以下とすることができます、基板の種類や延伸倍率等により適宜選択することができる。通常40°C以上250°C以下、好ましくは80°C以上220°C以下、さらに好ましくは100°C以上200°C以下とすることができます。ガラス転移点温度未満であると延伸を行うのに膨大な張力を必要とし、また融点を超えた温度だと、基板により大きな張力を課し、前記負の一軸性フィルムの延伸を制御できなくなるので好ましくない。

【0067】前記延伸は、一方向に張力をかける一軸延伸操作、又は互いに直交する二方向に張力をかける二軸延伸操作等により行うことができる。ただし本発明の方法においては、前記第1工程で既に負の一軸性の異方性が得られているので、二軸性フィルムを得るために一軸延伸操作で十分である。また、操作が簡便であり、装置が単純であり、また均一な屈折率分布を得るという観点からも一軸延伸操作の方が二軸延伸操作よりも好ましい。

【0068】前記一軸延伸を行う場合、延伸倍率は通常1.01倍以上2.0倍以下、好ましくは1.03倍以上1.5倍以下、さらに好ましくは1.05倍以上1.3倍以下とすることができます。延伸倍率が1.01倍未

満であると延伸による効果が十分でなくフィルムが負の一軸性に近い構造にしかならないおそれがあるため好ましくない。延伸倍率が2.0倍より大きい時は、延伸むらのためにフィルムが不均一な屈折率構造となってしまうおそれがある。

【0069】二軸延伸を行う場合は、直交する2方向の延伸方向のうちより大きい張力をかける方向の張力をTy、それに直交する方向にかける張力をTxとしたとき、TyをTxに比べ十分に大きくすることにより、具体的にはTy/Tx > 3、より好ましくはTy/Tx > 5、さらに好ましくはTy/Tx > 10であるような条件とすることにより、ある程度屈折率分布の少ない二軸性フィルムを得ることができ。Ty/Tx比は極力大きい方が屈折率分布の少ない二軸性フィルムを得る上で有利であり、Tx = 0の場合は一軸延伸に相当し最も好ましい。より大きい張力をかける方向の延伸倍率は通常1.01倍以上2.0倍以下、好ましくは1.03倍以上1.5倍以下、さらに好ましくは1.05倍以上1.3倍以下とすることができます。

【0070】前記延伸を行うことにより、3つの主屈折率のうちnx及びnzを大きく変化させることなくnyだけを大きく変化させ、ny > nx > nzの二軸構造を得ることができる。そのため、前記負の一軸性フィルムにおける(nx - nz) × dの値を大きく変化させることなく、もう一つの重要なパラメーターである面内のリターデーション値((ny - nx) × d)を延伸段階で制御することができる。なお、前記一軸延伸を行った場合は、通常、延伸方向を前記y方向、即ち3方向の主屈折率のうち最大の屈折率を有する方向とすることでき、前記二軸延伸を行った場合、前記Tyの張力をかけた延伸方向を前記y方向とすることができます。

【0071】本発明の方法を工業的に行う場合、前記第1工程において負の一軸性フィルムをロール状の基板上に形成し、さらに連続的に前記延伸を行うことが好ましい。この場合、延伸として一軸延伸を行う場合の延伸方向は、ロールの長手方向（この場合縦延伸）あるいは幅方向（この場合横延伸）とすることができる。工業的な観点からは縦延伸の方が容易で、より好ましい。前記縦延伸を行った場合、得られる二軸性フィルムの前記y方向は通常ロール長手方向とすることができます。一方前記横延伸を行った場合は、通常ロール幅方向が前記y方向になり縦延伸時とその方向は90度異なる。横延伸は縦延伸に比べると延伸のための装置が複雑になるという欠点があるが、得られる光学フィルムの用途によっては行う価値がある。例えば、本発明の方法によって得られるロール状二軸性のフィルムと他のロール状の光学フィルムを連続的に貼合する場合、二軸性のフィルムの最大屈折率方向の向きによって貼合物の光学性能は異なるので、光学性能の点で横延伸により製造された二軸性のフィルムの方が、より容易に連続的な貼り合わせが達成でき、

好ましい場合もありうる。なお、横延伸する場合、フィルムの搬送のためにある程度の張力が長手方向にも必要になる場合もあるが、この場合の長手方向の張力に対し幅方向の延伸の張力を十分に大きくすることにより、実質的な幅方向の一軸延伸を行うことができる。

【0072】前記延伸終了後、得られた前記二軸性フィルムは、必要に応じて室温まで冷却される。冷却速度や手段は特に制限はない。ただし、冷却前に急激に延伸時の張力を解放すると得られたフィルムにしわが入りやすいので、冷却工程の一部又は全部を、前記延伸においてかけた張力の解放の前に行なうことが好ましい。

【0073】前記負の一軸性フィルムを前記延伸フィルムと共に延伸した場合、必要に応じて基板である前記延伸フィルムを延伸工程後に除去することができ、あるいは製品を使用する上で問題なければ残しておくこともできる。

【0074】以上の工程により得られる二軸性フィルムは、そのまま製品である本発明の光学フィルムとすることも可能であるが、通常は比較的薄い膜であるので、前記第1工程で用いたものとは別の他の基板（以下、第1工程で用いた前記基板と区別して「第2の基板」という。）に転写して本発明の光学フィルムとすることがより好ましい。前記転写は、例えば、前記基板上の二軸性フィルムと第2の基板とを接着剤又は粘着剤を用いて貼り合わせ、次いで前記基板のみを、前記二軸性フィルムとの界面で剥離して除去することにより行なうことができる。

【0075】転写に用いられる第2の基板としては、適度な平面性を有するものであれば特に限定されないが、ガラスや、透明で光学的等方性を有するプラスチックフィルム等が好ましい。かかるプラスチックフィルムの例としては、ポリメタクリレート、ポリスチレン、ポリカーボネート、ポリエーテルスルファン、ポリフェニレンサルファイド、ポリアリレート、アモルファスポリオレフイン、トリアセチルセルロースあるいはエポキシ樹脂等のフィルムをあげることができる。なかでもポリメチルメタクリレート、ポリカーボネート、ポリアリレート、トリアセチルセルロース、ポリエーテルスルファン等が好ましく用いられる。また、光学的に異方性な基板も、目的とする用途にとって必要な部材である場合には第2の基板として使用することができる。このような光学的に異方性の第2の基板の例としては、ポリカーボネートやポリスチレン等のプラスチックフィルムを延伸して得られる位相差フィルム、偏光フィルム等が挙げられる。

【0076】転写に用いられる第2の基板と二軸性フィルムとを貼り合わせる接着剤又は粘着剤は、光学グレードのものであれば特に制限はないが、アクリル系、エポキシ系、ウレタン系等のものを用いることができる。

【0077】前記剥離の方法は、ロール等を用いて機械

的に剥離する方法、貼り合わせられた構造体の材料すべてに対する溶媒に浸漬したのち機械的に剥離する方法、前記溶媒中で超音波をあてて剥離する方法、前記基板と前記二軸性フィルムとの熱膨張係数の差を利用して温度変化を与えて剥離する方法等を例示することができる。剥離性は、二軸性フィルムに用いた材料と前記基板との密着性によって異なるため、その系に最も適した方法を採用することができる。

【0078】また、得られた二軸フィルムの表面はそのままでも製品である本発明の光学フィルムとすることができるが、必要に応じて表面に保護層を設けたり、粘着加工を行ったり、表面加工を行ったりして製品とすることもできる。

【0079】前記二軸性フィルム又は前記二軸性フィルムと第2の基板とを組み合わせたものは、そのまま、又は必要に応じて他の光学用フィルム、例えば他の屈折率構造を有する位相差フィルムや偏光板等と組み合わせ、製品である本発明の光学フィルムとすることができる。具体的には例えば、工業的に一般に製造されている形式の、ヨウ素を含漬したポリビニルアルコール膜を2枚の基板フィルムで保護した形の偏光板の中に、前記二軸性フィルムを組み込んで一体化し、製品である本発明の光学フィルムとすることもできる。

【0080】本発明の製造法は、均一性が高い本発明の光学フィルムを製造することができ、屈折率構造の制御が容易であるため、品質の高い、優れた機能を発揮する光学フィルムを製造することができる。とりわけ液晶ディスプレーの分野は、視覚に訴える用途であるため、使用する光学部材の均一性やバラメーターの妥当性が非常に厳しく評価されるが、本発明の製造法によれば、そのような要求にも十分応えることができる光学フィルムを製造できる。

【0081】本発明の光学フィルムは、光軸をフィルム面に投影したとき、その分布は、成膜材料溶液の塗工端を除けば、通常±5度以内とすることができます。基板として前記延伸フィルムを用い、前記負の一軸性フィルムと共に延伸する方法を採用すれば、通常±3度以内の分布を得ることができ、延伸温度の均一性及び延伸張力の均一性が高い条件に制御すれば±2度の制御も可能である。さらに一軸延伸の場合に限定すれば、通常±2度以内、条件を制御すれば±1度、最高±0.5度の制御が達成できる。

【0082】本発明の光学フィルムの用途は、特に限定されないが、位相差フィルム、偏光板と組み合わせた橢円偏光板等として用いることができる。

【0083】本発明の液晶表示装置は、前記本発明の光学フィルムを含む。

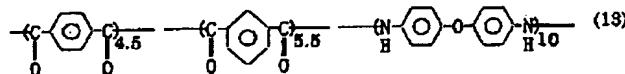
【0084】本発明の液晶表示装置の形式は、特に限定されず、例えばSTN (Super Twisted Nematic) セル、TN (Twisted Nematic)

tic) セル、VA (Vertical Aligned) セル、OCB (Optically Controlled Birefringence) セル、HAN (Hybrid Aligned Nematic) セル、及びこれらに規則正しい配向分割を施したもの、ランダムな配向分割を行ったもの等の、各種のセルを含むものとすることができる、また、単純マトリックス方式、TFT (Thin Film Transistor) 電極やMIM (Metal Insulator Metal) 電極等を用いたアクティブマトリックス方式、セルの面内方向に駆動電圧を印加するIPS (In-Plane Switching) 方式、プラズマアドレッシング方式等の各種の駆動方式を探るものとすることができる。また、バックライトシステムを備えた透過型のもの、あるいは反射板を供えた反射型のもの、さらには投射型のものとすることもできる。

【0085】本発明の液晶表示における、前記光学フィルムを備える態様は、特に限定されないが、通常、偏光板と駆動セルとの間であって、駆動セルの上側及び/又は下側の位置に、1枚若しくは複数枚前記光学フィルムを配置する態様を挙げることができる。なかでも駆動セルの上側と下側に当該フィルムを1枚ずつ配置する態様が好ましい。またさらに別の光学用フィルム、例えば本発明の光学フィルムとは異なる屈折率構造を有する位相差フィルム、散乱フィルム、レンズシート等と組み合わせた態様とすることもできる。

【0086】

【発明の効果】本発明の光学フィルムの製造法は、特定の負の一軸性フィルムを得る工程とそれを延伸する工程とを含むことにより、屈折率分布の制御が容易でかつ均一性



【0092】このポリアミドの固有粘度は1.6 d1/gであった(30°C、0.5 g/d1のN-メチル-2-ピロリドン(NMP)溶液)。このポリアミドをNMPに溶解させ6重量%の成膜材料溶液を調製した。この成膜材料溶液を厚さ80 μm、長さ30 cm、幅20 cmのポリエチレンナフタレートフィルム(帝人(株)製)にスピンドルコート法を用いて塗布し、80°Cのオーブン中で1時間乾燥処理を行い、積層フィルムを得た。この積層フィルムを数枚調製した。次いで、150°Cのオーブン

中でそれぞれの積層フィルムを一定速度(10 mm/min)で、表1に示す様々な延伸倍率で一軸延伸した。延伸は前記積層フィルムの長さ方向に行った。延伸後のそれぞれの積層フィルムの一部を切りだし、ポリアミド膜を剥離し、これらを試料とし、屈折率測定及び膜厚測定を行った。結果を表1に示す。

【0093】

【表1】

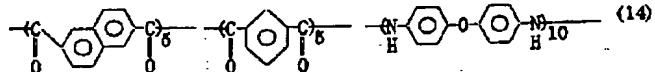
試料番号	延伸倍率	膜厚(μm)	ny	nx	nz
1	延伸無し	6.3	1.687	1.687	1.665
2	1.16	5.9	1.707	1.688	1.667
3	1.24	5.8	1.713	1.684	1.664
4	1.32	6.0	1.720	1.682	1.662

【0094】3方向の屈折率から、延伸していないポリアミド膜(試料番号1)はny=nx>nzの負の一軸

性構造を有する一方、延伸したポリアミド膜(試料番号2~4)はny>nx>nzの二軸性構造を有すること

が分かった。ここで最大屈折率方向yは延伸した方向であった。

【0095】剥離ポリアミド膜自身は薄膜であり自己支持性に乏しかったため、前記積層フィルムの、前記測定に用いなかった残りの部分を用い、ポリアミド膜の他の透明基板への転写を行った。表面に粘着剤を塗布した透明なソーダガラス板（厚さ1.1mm）を調製し、その上に前記積層フィルムを、粘着剤とポリアミド膜が接するように貼り合わせ、次いでポリエチレンテレフタレートフィルムを剥離した。このようにして二軸性屈折率構*10



【0097】このポリマーの固有粘度は1.5d1/gであった（30°C、0.5g/dlのNMP溶液）。このポリマーをNMPに溶解し、ポリマー濃度4重量%の成膜材料溶液を調製した。

【0098】この成膜材料溶液を、幅40cm、長さ500m、厚さ80μmのポリエチレンテレフタレートフィルムの上にロールコーティングを用いて連続的に塗布し、100°Cで乾燥処理し、積層フィルムを得た。この積層フィルムを150°Cに加熱しつつ、長手方向に55Kgfの張力をかけて延伸を行った。延伸後の積層フィルムは、長手方向は1.09倍に伸び、幅方向は約0.95倍に収縮していた。延伸後の積層フィルム上のポリマー層の膜厚は10μmであった。

【0099】ポリエチレンテレフタレートフィルムが、面内で均一性の低い複屈折性をもっており、光学的性質を測定する上で望ましくないため、次の剥離転写操作を行った。

【0100】まず、延伸した積層フィルム上のポリマー層の上に紫外線硬化型接着剤を塗布し、その上にトリアセチルセルロースフィルム（長さ500m、幅40cm、厚み80μm、富士写真フィルム社製）をラミネートした。紫外線を照射して接着剤を硬化させた後、ポリエチレンテレフタレートをポリマー層から剥離し、トリアセチルセルロースフィルムとポリマー層との積層物を得た。

【0101】得られた積層物を偏光解析した。光軸は2本あり、光軸が積層物の法線となす角はいずれも38度であった。また光軸を積層物の面に投影した方向は、積層物の長手方向と一致した。

【0102】また、この積層物を1m切り出し、長手方向、幅方向に関し1cmおきに面内のリターデーションを測定して分布を調べた（ただしポリマー層が積層された部分の幅方向の両端5cmを除く）。その結果、リターデーション値は213nm±2nmの範囲にあり、±1%以内の精度で複屈折性が制御できていることがわかった。従って、得られた積層物は、均一な二軸性のフィルムであることがわかった。

* 造を有するポリアミド膜を表面に備えた、積層ガラスを得ることができた。得られた積層ガラスを2枚のクロスニコル下の偏光板に挟んでむらの様子を観察したところ、均一なポリマーの膜が得られていることが分かった。

（実施例2）成膜材料として、式（14）で表わされるポリマーを合成した。

【0096】

【化15】

（実施例3）実施例2と同じ成膜材料溶液及びポリエチレンテレフタレートフィルムを用い、同様に塗布及び乾燥を行い、積層フィルムを調製した。この積層フィルムを、180°Cに加熱しつつテンダーを用いて横延伸した。横方向の張力は長さ1cmあたり0.9Kgfとし、長手方向には搬送のため3Kgfの張力（1cmあたり0.07Kgf）をかけた。延伸によりフィルム幅は約6%増加した。延伸後、実施例2と同様にトリアセチルセルロースフィルムにポリマー層を転写し、トリアセチルセルロースフィルムとポリマー層との積層物を得た。

【0103】得られた積層物を偏光解析した。光軸は2本あり、光軸が積層物の法線となす角はいずれも24度であった。また光軸を積層物の面に投影した方向は、積層物の幅方向とほぼ一致し、積層物の面内の場所による分布は±1度であった。また面内のリターデーションの分布は±2%以内であった。従って、得られた積層物は、均一な二軸性フィルムであることがわかった。

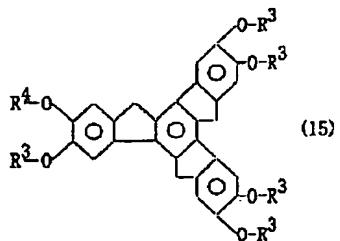
（実施例4）本発明の光学フィルムの態様の一つとしての、偏光素子と二軸性フィルムとを一体化した光学素子を作製した。

【0104】延伸したポリビニルアルコール膜にヨウ素を含浸させ、これを熱硬化型接着剤を用いてトリアセチルセルロースフィルム上に接着し、ポリビニルアルコールトリアセチルセルロース積層物を得た。次に実施例3で得られたトリアセチルセルロースフィルムとポリマー層との積層物上のポリマー層上に熱硬化型接着剤を塗布し、前記ポリビニルアルコールトリアセチルセルロース積層物のポリビニルアルコール膜側と貼り合わせ、熱をかけて接着剤を硬化させた。なお貼り合わせ方向は、ポリビニルアルコール膜の延伸方向と実施例3の積層物のロール長手方向とが平行になるようにした。このようにして、二枚のトリアセチルセルロースフィルムの間に偏光層及び複屈折層を有する光学素子を作製することができた。

（実施例5）式（15）の化合物を合成した。

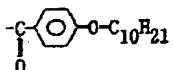
【0105】

【化16】

【0106】(式中R³は

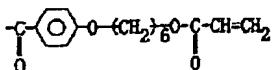
【0107】

【化17】

【0108】で表わされる基を示し、R⁴は

【0109】

【化18】

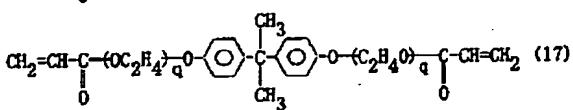
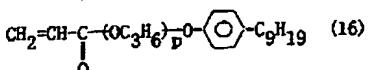


【0110】で表わされる基を示す。)

また式(16)及び式(17)の化合物を入手した(それぞれ東亜合成(株)製アロニックスM-117及びM-210)。

【0111】

【化19】



【0112】(式中p及びqは平均の重合度であり、それぞれ約4、約2である。)

これらの化合物を、式(15)の化合物:式(16)の化合物:式(17)の化合物=50:45:5の重量比で混合し、ポリマーフィルムのための出発原料とした。なお、式(15)の化合物は単独ではディスコチック液晶相を有する化合物であるが、前記出発原料は液晶性を示さず、室温下では粘ちゅうな液体であった。

【0113】光開始剤イルガキュア907(Ciba-Geigy社製)を前記出発原料に対し1.5重量%加え、成膜材料組成物とした。これにジエチレングリコールジメチルエーテル溶媒を加えて、成膜材料組成物濃

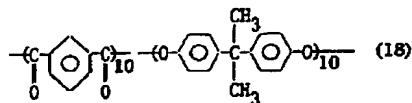
度15重量%の溶液を調製した。

【0114】この溶液を、厚さ50μm、長さ30cm、幅20cmのポリフェニレンサルファイドフィルム(東レ(株)製)にスピンコート法を用いて塗布し、80°Cのオーブン中で10分間乾燥処理を行ない、さらに温度を60°Cに保ちつつ、高圧水銀ランプにより塗布面に紫外線照射を行い、成膜材料組成物を光硬化させてポリマー化させ、ポリマー層を有する積層フィルムを得た。得られた積層フィルム上のポリマー層の屈折率を測定したところ、負の一軸性構造を有しており、面内の屈折率は一定で1.59、膜厚方向の屈折率は1.56であることがわかった。

【0115】次に、200°Cのオーブン中で前記積層フィルムを一定速度(10mm/min)で、長手方向に1.1倍に一軸延伸した。延伸後のフィルムの屈折率は、ny=1.61、nx=1.58、nz=1.56であった。得られた積層フィルム上のポリマー層を、実施例1と同様に、ガラス基板上へ転写した。偏光下で観察を行い、その結果、ガラス基板上のポリマー層はむらのない均質な二軸性構造を有していることが分かった。(実施例6)成膜材料として、式(18)で表わされるポリマーを合成した。

【0116】

【化20】



【0117】このポリマーの固有粘度は0.65dl/gであった(30°C、0.5g/dlのNMP溶液)。この成膜材料をNMPに溶解させ4重量%の成膜材料溶液を調製し、20cm角のアルミ板に塗布し、80°Cのオーブン中で乾燥させ、積層板を得た。この積層板上のポリマー層の膜厚は45μmであった。次いで、ポリマー層を注意深くアルミ板から剥がしとりポリマー膜を得、これを140°Cで1.05倍に延伸した。延伸後のポリマー膜は透明で二軸性を有していた。偏光解析により、(nx-nz)と膜厚の積であるリターデーションを求めたところ、100nmであった。また、(ny-nz)と膜厚である面内のリターデーションは約390nmであった。光軸のポリマー膜の面への投影方向を、ポリマー膜中心部の10cm角の範囲について調べたところ、ポリマー膜の延伸方向を中心に±4度の分布があった。また面内のリターデーションの分布は390nm±18nmであった。

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QC02 QG01 QG15 QG18

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the liquid crystal display which contains this optical film in optically biaxial optical films suitable as various optical films, such as a phase contrast film and a polarization film, and those manufacturing methods, and a list.

[0002]

[Description of the Prior Art] The optically biaxial film which controlled the refractive index of three dimensions is useful in the optical field using polarization. The importance of such a film that can especially control polarization in the field of a liquid crystal display finely is high.

[0003] Many of optical films of the form birefringence which can be used for a current industrial target have optically uniaxial refractive-index structure. There are a thing forward in axial, a negative thing and a thing that has an optical axis in a film plane, a thing which exists in the direction of a film normal. For example, the color compensation film used for the STN (Super Twisted Nematic) liquid crystal display is a forward optically uniaxial film which has an optical axis in a field. Moreover, Harris and others has acquired the negative optically uniaxial structure of having an optical axis in the direction of a film normal, by drying the solution of a specific polymer on a substrate and carrying out plane orientation of the polymer, for example (U.S. Pat. No. 5344916, No. 6480964, and No. 5580950). This manufacturing method deserves attention as a simple manufacturing method of an optical film. However, with an optically uniaxial optical film with high symmetric property, there is a limitation in the effectiveness in control of the polarization etc. naturally.

[0004] On the other hand, an optically biaxial film can be produced by biaxial stretching of a polymer film, and has the report of a large number about this. However, there is a problem in the quality of the film obtained. That is, in order to control the refractive-index structure of a three way by balance of extension of two directions, refractive-index control is difficult and it is difficult for the obtained film to obtain a uniform film that it can be tended in a field to perform distribution of refractive-index structure.

[0005] Thus, when producing an optically biaxial film industrially, the big technical problem is left behind.

[0006]

[Problem(s) to be Solved by the Invention] The purpose of this invention has control of refractive-index distribution in offering the approach of manufacturing an easy and homogeneous optically biaxial high optical film.

[0007] It can manufacture easily, refractive-index distribution is correctly controlled by the desired value, and another purpose of this invention is to offer a homogeneous high optical film.

[0008] The refractive index of the transmitted light is controlled correctly, and another purpose of this invention has the high engine performance, and is to offer the liquid crystal display which can be manufactured easily.

[0009]

[Means for Solving the Problem] As an approach of acquiring 2 shaft structures, this invention persons did not depend only on extension, but as a result of considering using two different technique gradually and performing ***** examination based on it, they reached this invention at last.

[0010] That is, according to this invention, the manufacturing method of the optical film characterized by including the process which was allotted and dried on the substrate and carried out plane orientation of the membrane formation ingredient solution, and which obtains a negative optically uniaxial film optically, and the process which extends said negative optically uniaxial film and is used as an optically biaxial film is offered.

[0011] Moreover, according to this invention, the manufacturing method of said optical film characterized by

said substrate, being an oriented film is offered.

[0012] Furthermore, according to this invention, in the process which extends [] negative optically uniaxial film, the manufacturing method of said optical film characterized by extending heating said negative optically uniaxial film with said oriented film is offered.

[0013] Furthermore, according to this invention, the optical film obtained according to said manufacturing method is offered.

[0014] Furthermore, according to this invention, said optical film characterized by distribution of the projection direction to the film plane of a film optical axis being less than **2 degrees is offered.

[0015] Furthermore, according to this invention, the liquid crystal display component characterized by including said optical film is offered.

[0016]

[Embodiment of the Invention] The approach of this invention is an approach of manufacturing an optical film, and is an approach of manufacturing the optically biaxial optical film which has especially the refractive-index structure of $ny > nx > nz$. In this specification, nx , ny , and nz are the principal indices of refraction of three directions of x directions, the direction of y , and the direction of z , respectively, x directions and the direction of y are the directions of [in the film plane which intersects perpendicularly mutually], and the direction of z is made into the direction of thickness of a film.

[0017] By the approach of this invention, the process (henceforth the 1st process) which was allotted and dried on the substrate and carried out plane orientation of two steps of processes which form a film, i.e., the membrane formation ingredient solution, and which obtains a negative optically uniaxial film optically, and the process (henceforth the 2nd process) which extends said negative optically uniaxial film and is used as an optically biaxial film are included, controlling a refractive index.

[0018] Especially as said substrate used for the 1st process, it is not limited but a plastic plate, a glass plate, or metal plates, such as plastic film, etc. can be used. If oriented films, such as plastic film which has thickness suitable as a substrate, are used, especially since both negative optically uniaxial films and substrates can be extended in the 2nd process, it is desirable.

[0019] Especially the latter is desirable, although what performed extension actuation can be mentioned after forming membranes as said plastic film through the thing made by the cast method, or the melting condition of a polymer. This is because a more precise negative 1 shaft film can be transformed, when the direction of the latter film discovers a certain amount of [a substrate] reinforcement in the 2nd extension process.

[0020] As said plastic film, polyolefines, such as polyethylene and polypropylene, Polyimide, polyamidoimide, a polyamide, polyether imide, A polyether ether ketone, a polyether ketone, poly ketone sulfide, Polyether sulfone, polysulfone, polyphenylene sulfide, Polyphenylene oxide, polyethylene terephthalate, polybutylene terephthalate, Films, such as polyethylenenaphthalate, polyacetal, a polycarbonate, polyarylate, acrylic resin, polyvinyl alcohol, polypropylene, cellulose system plastics, an epoxy resin, and phenol resin, can be mentioned. Especially, polyethylene, polypropylene, polyethylene terephthalate, polyethylenenaphthalate, especially a cellulose plastic, etc. are desirable. Moreover, what performed surface treatment, such as hydrophilization processing and hydrophobing processing, can also be used for these plastic film.

[0021] Thickness of said plastic film can usually be set to 20 micrometers or more 200 micrometers or less, and is 60 micrometers or more 100 micrometers or less especially preferably 30 micrometers or more 150 micrometers or more preferably. Since there is a possibility that extension unevenness may arise when it extends with said negative optically uniaxial film in the 2nd process, since the reinforcement of a film is weak when thinner than 20 micrometers, it is not desirable. In the case of 200 micrometers or more, since there is a possibility that required tension may become large too much in extension, and it may not be suitable for industrial production, it is not desirable.

[0022] The solution which contains membrane formation ingredients, such as various kinds of polymers and a low molecular weight compound in which a polymerization is possible, as said membrane formation ingredient solution can be used. In order to acquire form birefringence large enough (i.e., in order for $nx-nz$ to obtain a negative, optically uniaxial film large enough), the thing containing a membrane formation ingredient with at least one or more kinds of aromatic series rings is desirable.

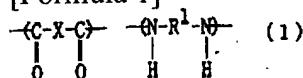
[0023] The low molecular weight compound which can give various kinds of polymers, such as a polyamide which specifically has at least one or more kinds of aromatic series rings as said membrane formation ingredient, polyimide, polyamic acid, polyester, or polyester amide, or these polymers and in which a polymerization is possible can be mentioned. These may be used independently, and it may mix and they may

be used.

[0024] The polymer which includes the polymerization unit expressed with the following type (1), for example as said polyamide is mentioned.

[0025]

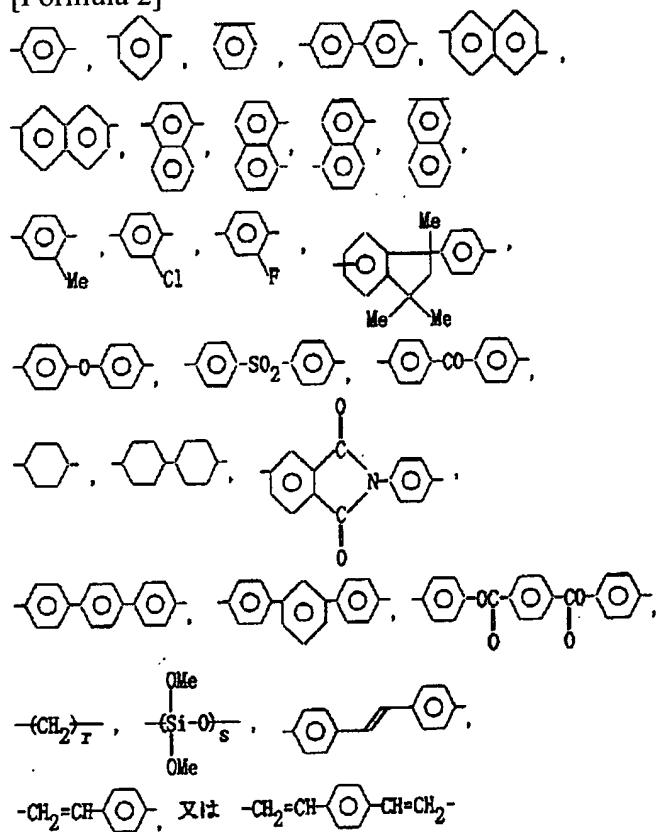
[Formula 1]



[0026] The inside X and R1 of a formula is the residue of arbitration, and is radicals in which at least one side contains a ring.

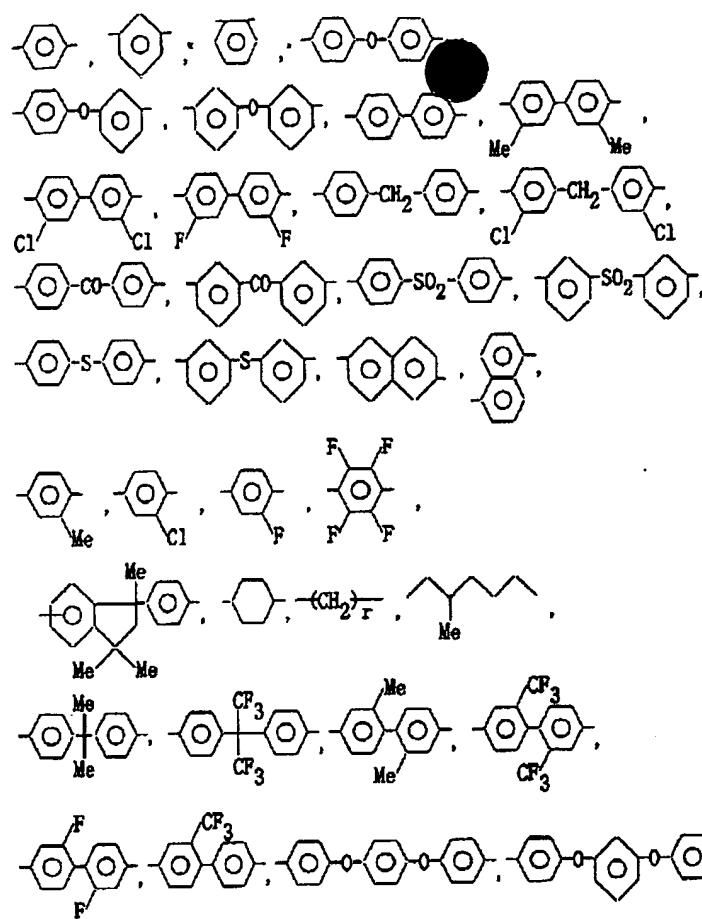
[0027] Said X is [0028].

[Formula 2]



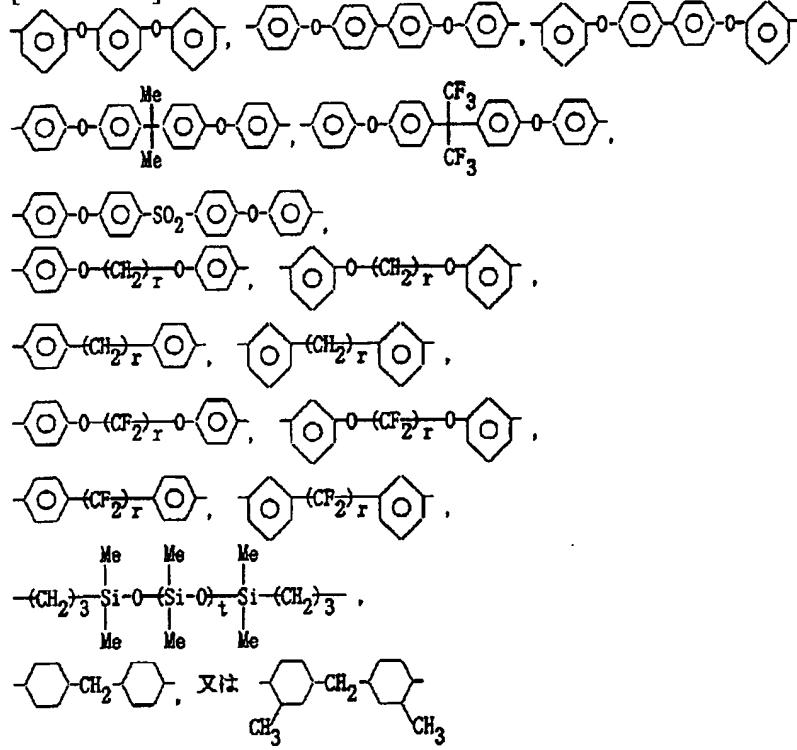
[0029] It is desirable that it is the radical of ** and R1 is [0030].

[Formula 3]



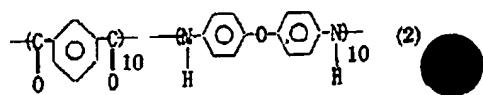
[0031]

[Formula 4]

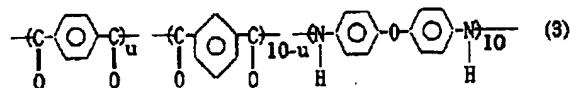


[0032] It is desirable that it is the radical of **. However, as for the inside r of a formula, the number of 2-12 is shown, s shows the number of 1-500, and t shows the number of 0-500.

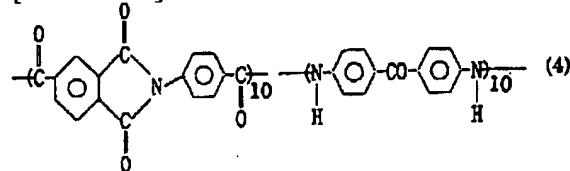
[0033] More specifically as said polyamide, it is the polymer expressed with the following type (2), and [0034]. [Formula 5]



[0035] The polymer, [0036] which are expressed with a formula (3)
 [Formula 6]



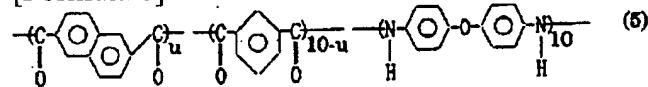
[0037] The polymer, [0038] which are expressed with a formula (4)
 [Formula 7]



[0039] The polymer expressed with a formula (5) to a list can be mentioned.

[0040]

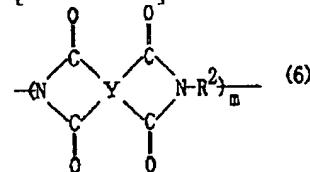
[Formula 8]



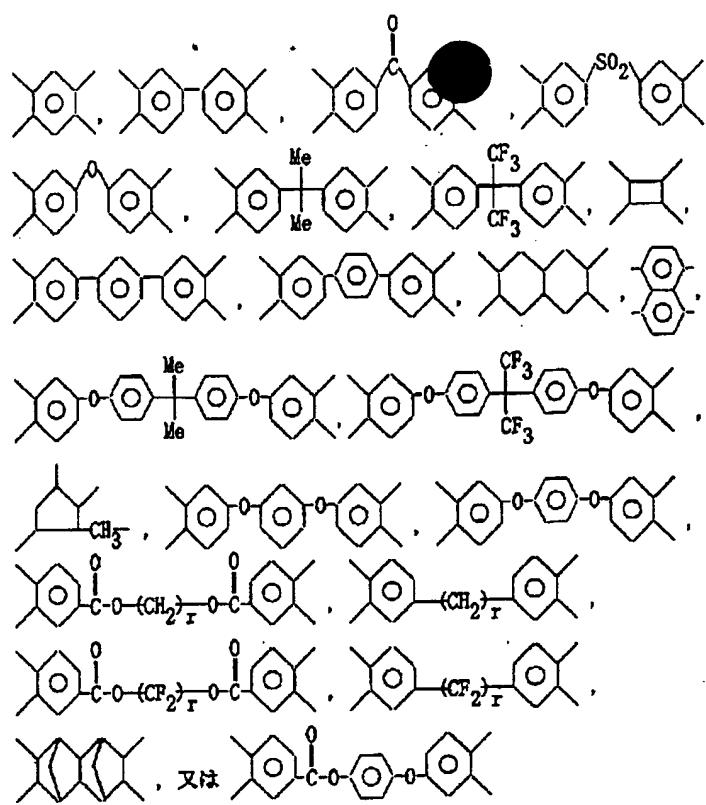
[0041] However, u shows the number of $0.5 \leq u \leq 9.5$.

[0042] As said polyimide, it is polymer: [0043] shown, for example by the following formula (6).

[Formula 9]

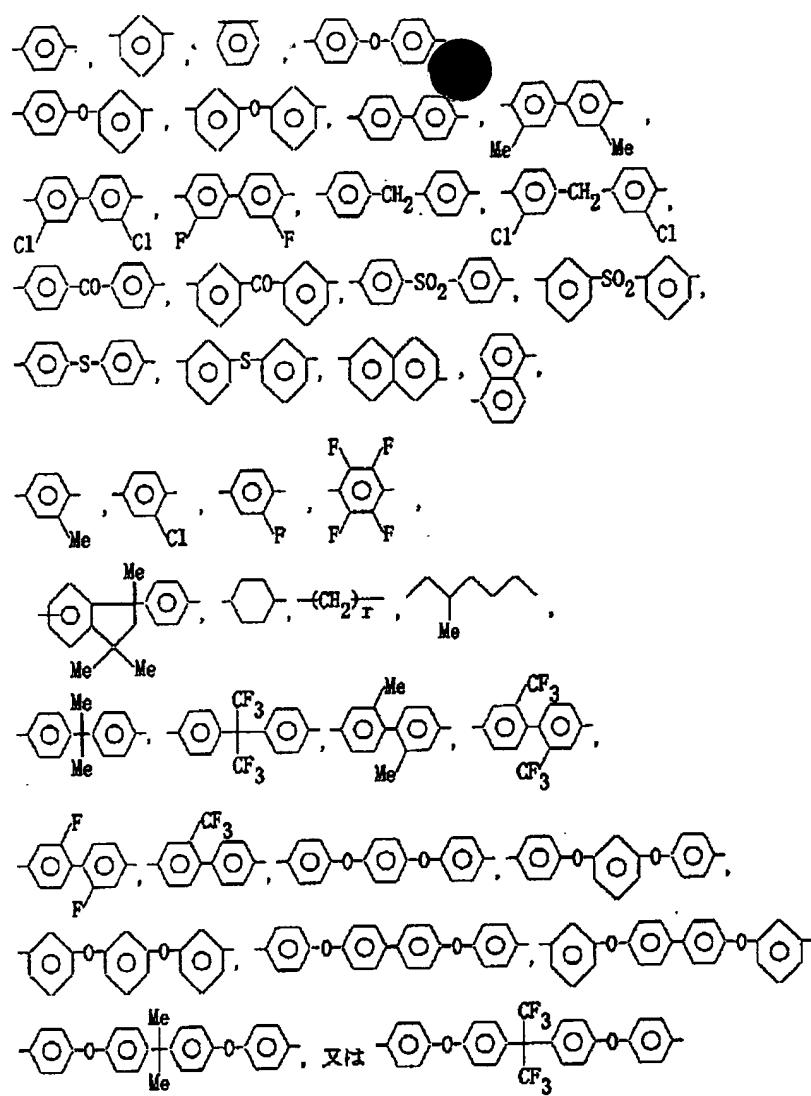


[0044] (The inside m of a formula is average degree of polymerization.) Moreover, Y is [0045].
 [Formula 10]



[0046] The radical of ** is shown and R2 is [0047].

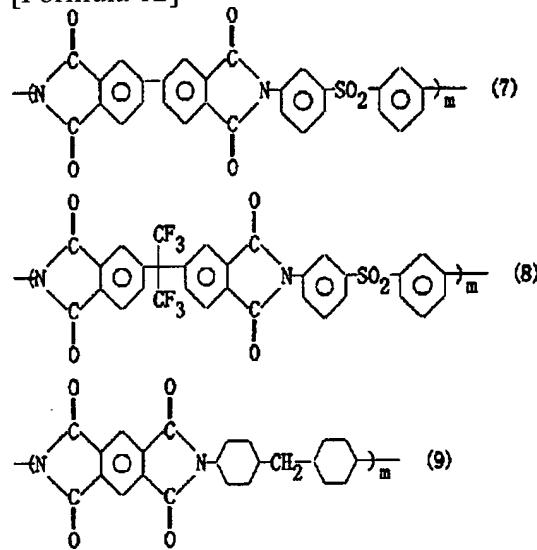
[Formula 11]



[0048] The radical of ** is shown. It can mention and, more specifically, the polymer shown by following type (7) - (9) can be mentioned.

[0049]

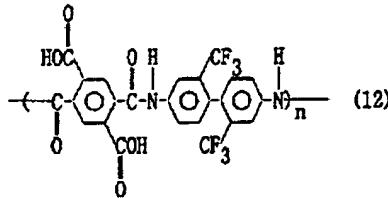
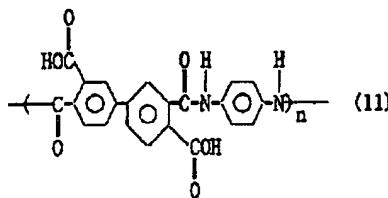
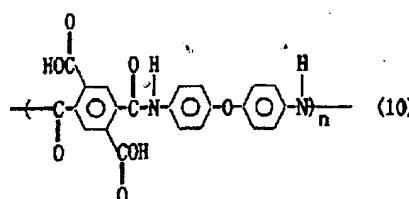
[Formula 12]



[0050] As said polyamic acid, the polymer shown, for example by following type (10) - (12) can be mentioned.

[0051]

[634] [Formula 13]



[0052] (The number of 2-400 is shown by the inside n of a formula.)

In addition, when using said polyamic acid, after solution-applying and drying, the 2nd process can also be performed as it is, but the 2nd process can also be presented after imide-izing by heat treatment.

[0053] the concentration of said membrane formation ingredient in said membrane formation ingredient solution -- usually -- it can take still more preferably for 20 or less % of the weight 2% of the weight or more 30 or less % of the weight 1% of the weight or more preferably 40 or less % of the weight 0.5% of the weight or more.

[0054] In said membrane formation ingredient solution, it can choose suitably according to the membrane formation ingredient and substrate to be used that what is necessary is just what can dissolve said membrane formation ingredient and does not corrode a substrate film to the degree of pole as a solvent in which said membrane formation ingredient is dissolved. Specifically For example, chloroform, dichloromethane, a carbon tetrachloride, a dichloroethane, Tetrachloroethane, TORITORI chloroethylene, tetrachloroethylene, Halogenated hydrocarbon, such as a chlorobenzene and an orthochromatic dichlorobenzene Phenols, such as a phenol and parachlorohenol, benzene, toluene, Aromatic hydrocarbon, such as xylene, methoxybenzene, 1, and 2-dimethoxybenzene An acetone, ethyl acetate, t-butyl alcohol, a glycerol, ethylene glycol, Triethylene glycol, ethylene glycol monomethyl ether, Diethylene-glycol wood ether, propylene glycol, dipropylene glycol, The 2-methyl -2, 4-pentanediol, ethyl Cellosolve, butyl Cellosolve, These mixed solvents, such as 2-pyrrolidone, a N-methyl-2-pyrrolidone, a pyridine, triethylamine, dimethylformamide, dimethylacetamide, an acetonitrile, butyronitrile, and a carbon disulfide, etc. are used. Moreover, a sulfuric acid can also be used depending on the membrane formation ingredient to be used.

[0055] In addition to said membrane formation ingredient and solvent, said membrane formation ingredient solution may add other additives, such as a surfactant, according to the purpose.

[0056] In said 1st process, especially the method of arranging said membrane formation ingredient solution on said substrate is not limited, but can be performed by the spin coat method, the roll coat method, the die coat method, etc. After allotting on a substrate so that the film which can obtain said membrane formation ingredient solution by these approaches may become desired thickness, a negative optically uniaxial film can be obtained by making it dry. Although drying temperature can be suitably chosen according to the class of solvent etc., 40 degrees C or more 250 degrees C or less can usually be preferably made into 50 degrees C or more 200 degrees C or less. Desiccation may be performed under constant temperature, and gradually, temperature is raised and may be performed. The drying time can usually be preferably made below into for 15 minutes more than for 2 minutes still more preferably below for 20 minutes more than for 30 seconds below for 30 minutes more than for 10 seconds.

[0057] Although a polymer can consider as the negative optically uniaxial film which carried out plane orientation (phenomenon which an anisotropy produces in molecular orientation since the paint film which contains a solvent at the time of desiccation contracts in the direction of thickness) by arranging a membrane formation ingredient solution on a substrate, and making it dry when said various kinds of polymers are used as

said membrane formation ingredient. When the low molecular weight compound in which a polymerization is possible as said membrane formation ingredient is used, a membrane formation ingredient solution is arranged on a substrate, and after making it dry and obtaining the plane orientation object of a low molecular weight compound, it can be considered as a negative optically uniaxial film by constructing a bridge by heat or light if needed.

[0058] Said negative optically uniaxial film means the film with which the principal indices of refraction n_x and n_y fill a larger relation than n_z almost identically. If the difference of n_x and n_y is or less 0.001 extent, specifically, it can be used as what has optically uniaxial [negative].

[0059] When a film is created according to said 1st process, the value of the principal indices of refraction n_x , n_y , and n_z is a value to which it comes as *****, if dependent on the usually used ingredient and the conditions to produce, can choose thickness according to the purpose and can control the retardation value ($n_x - n_z$) (value acquired by the product of Thickness d) of the thickness direction in the field which is an important parameter optically.

[0060] The large thing to some extent of the difference of the refractive index of field inboard and the refractive index of the thickness direction, i.e., $n_x - n_z$, is desirable, and it is [0.002 or more / 0.005 or more] usually preferably desirable [$n_x - n_z / 0.01$ or more] in said negative optically uniaxial film, to carry out to 0.02 or more preferably especially still more preferably. Thickness of a film must be thickened in order to obtain the retardation of the request about the thickness direction in a field, when this refractive-index difference is small. Since uniform structure becomes hard to be acquired in an extension process when this thickness is too thick so that it may state later, as for the value of $n_x - n_z$, it is desirable that it is 0.002 or more.

[0061] the retardation value of the thickness direction of said negative optically uniaxial film, i.e., ($n_x - n_z$), the value given by x_d , -- usually -- 20nm or more 2000nm or less 50nm or more 1000nm or less can be more preferably set to 100nm or more 600nm or less still more preferably. In the case of less than 20nm, a retardation value is too small, and since there is a possibility that the function as an optical element may be missing, it is not desirable. Since there is a possibility of unevenness being made and giving an uneven film at the time of spreading or desiccation when exceeding 2000nm, it is not so desirable. moreover, the thickness of said negative optically uniaxial film -- usually -- 0.2 micrometers or more 100 micrometers or less 0.5 micrometers or more 50 micrometers or less can be preferably set to 1 micrometers or more 20 micrometers or less still more preferably. In the case of less than 0.2 micrometers, although based also on the birefringence value ($n_x - n_z$) of a film, since there is a possibility that the function as an optical element may be missing since a retardation value becomes small generally, it is not desirable. Since there is a possibility of unevenness being made and giving an uneven film at the time of spreading or desiccation when exceeding 100 micrometers, it is not desirable.

[0062] Moreover, when extending said negative optically uniaxial film with said substrate in the 2nd next process, as for the thickness of said negative optically uniaxial film, it is desirable that it is smaller than the thickness of said substrate, and its small thing is still more desirable than the one half of the thickness of said substrate. By making small relatively thickness of said negative optically uniaxial film to the thickness of said substrate, when these [both] are extended, uniform extension can be performed.

[0063] The approach of this invention includes the 2nd process which extends said negative optically uniaxial film and is used as an optically biaxial film following said 1st process.

[0064] When a glass plate or a metal plate is used as said substrate, said extension can perform the negative optically uniaxial film obtained according to the 1st process, after it exfoliates from a substrate. When oriented films, such as plastic film which, on the other hand, has thickness suitable as said substrate, are used, said negative optically uniaxial film can be extended with a substrate, without exfoliating from a substrate.

[0065] Since uniform extension can be performed compared with the case where said negative optically uniaxial film is independently extended since tension was imposed on said substrate, said substrate extended to homogeneity and said negative optically uniaxial film was indirectly extended with this uniform extension when said negative optically uniaxial film was extended with said oriented film etc., it is desirable. When thickness of said negative optically uniaxial film is relatively made small to the thickness of said substrate and these [both] are extended especially, especially since tension is mainly imposed on said substrate and uniform extension is attained, it is desirable.

[0066] Said extension has desirable ** performed heating said negative optically uniaxial film with said oriented film as a substrate. More than the glass transition point of ****, whenever [stoving temperature] can be made below into the melting point, and can be suitably chosen by a class, draw magnification, etc. of a substrate. Usually, 40 degrees C or more 250 degrees C or less 80 degrees C or more 220 degrees C or less can

be preferably made into 100 degrees C or more 200 degrees C or less still more preferably. Since big tension is imposed with a substrate and it becomes impossible to control extension of said negative optically uniaxial film in case of the temperature which needed huge tension for performing relations a total as it is under glass transition point temperature, and exceeded the melting point, it is not desirable.

[0067] The uniaxial-stretching actuation which applies tension to an one direction, or the biaxial-stretching actuation to which tension is applied in the two directions which intersect perpendicularly mutually can perform said extension. However, in the approach of this invention, since the negative optically uniaxial anisotropy has already been acquired at said 1st process, in order to obtain an optically biaxial film, uniaxial-stretching actuation is enough. Moreover, actuation is simple and the uniaxial-stretching actuation also from a viewpoint that equipment acquires uniform refractive-index distribution simply is more desirable than biaxial-stretching actuation.

[0068] the case where said uniaxial stretching is performed -- draw magnification -- usually -- it can take still more preferably for 1.3 or less times 1.05 or more times 1.5 or less times 1.03 or more times preferably 2.0 or less times 1.01 or more times. The effectiveness according that draw magnification is less than 1.01 times to extension is not enough, and since there is a possibility that a film may become only the structure near optically uniaxial [negative], it is not desirable. When draw magnification is larger than 2.0 times, there is a possibility that a film may become uneven refractive-index structure for extension unevenness.

[0069] When tension to which the tension of the direction to which tension larger when performing biaxial stretching than the inside of the extension direction of the 2-way which intersects perpendicularly is applied is applied in the direction which intersects perpendicularly with T_y and it is set to T_x , $T_y/T_x > 3$ can be obtained and an optically biaxial film with to some extent little refractive-index distribution can specifically be obtained by enlarging T_y enough compared with T_x by considering as $T_y/T_x > 5$ and conditions which are $T_y/T_x > 10$ still more preferably more preferably. The T_y/T_x ratio is advantageous when the larger one obtains an optically biaxial film with little refractive-index distribution as much as possible, in the case of $T_x=0$, it is equivalent to uniaxial stretching, and it is the most desirable. the draw magnification of the direction to which larger tension is applied -- usually -- it can take still more preferably for 1.3 or less times 1.05 or more times 1.5 or less times 1.03 or more times preferably 2.0 or less times 1.01 or more times.

[0070] By performing said extension, only n_y can be changed a lot, without changing the inside n_x and n_z of the three principal indices of refraction a lot, and 2 shaft structures of $n_y > n_x > n_z$ can be acquired. Therefore, the retardation value ($n_y - n_x$) within another field which is an important parameter (x_d) can be controlled by the extension phase, without changing the value of x_d in said negative optically uniaxial film ($n_x - n_z$) a lot. In addition, when the extension direction can usually be made into the direction which has the greatest refractive index among the principal indices of refraction of the said direction of y , i.e., three directions, when said uniaxial stretching is performed, and said biaxial stretching is performed, the extension direction to which said tension of T_y was applied can be made into said direction of y .

[0071] When performing the approach of this invention industrially, it is desirable to form a negative optically uniaxial film on a roll-like substrate in said 1st process, and to perform said extension still more nearly continuously. In this case, the extension direction in the case of performing uniaxial stretching as extension can be made into the longitudinal direction (vertical extension in this case) or the cross direction (horizontal extension in this case) of a roll. From a industrial viewpoint, the vertical extension is easier and it is more desirable. When said vertical extension is performed, said direction of y of the 2 shaft film obtained can usually be made into a roll longitudinal direction. On the other hand, when said horizontal extension is performed, the roll cross direction usually becomes in said direction of y , and the time of vertical extension differs from its direction 90 degrees. Although horizontal extension has the fault that the equipment for extension becomes complicated compared with vertical extension, there is value performed depending on the application of the optical film obtained. For example, since the optical-character ability of a pasting object changes with sense of the maximum refractive-index direction of an optically biaxial film when pasting continuously together the roll-like optically biaxial film obtained by the approach of this invention, and the optical film of the shape of other roll, continuous lamination can be attained more easily [the optically biaxial film manufactured by horizontal extension in respect of optical-character ability], and it may be desirable. In addition, although a certain amount of tension for conveyance of a film may be needed also for a longitudinal direction when carrying out horizontal extension, uniaxial stretching of the substantial cross direction can be performed by enlarging tension of crosswise extension enough to the tension of the longitudinal direction in this case.

[0072] Said obtained optically biaxial film is cooled to a room temperature after said extension termination if

needed. Especially a limit has neither a cooling rate nor a means. However, since a wrinkling tends to go into the film obtained when the tension at the time of extension was rapidly released before cooling, it is desirable to carry out before release of the tension to which a part or all of a cooling process was applied in said extension. [0073] When said negative optically uniaxial film is extended with said oriented film, it can also leave, if satisfactory when said oriented film which is a substrate can be removed after an extension process if needed or a product is used.

[0074] Although it is possible also for considering as the optical film of this invention which is a product as it is, since the optically biaxial film obtained according to the above process is the usually comparatively thin film, it is more desirable to imprint to other substrates (henceforth "the 2nd substrate" in distinction from said substrate used at the 1st process) different from what was used at said 1st process, and to consider as the optical film of this invention. Subsequently said imprint can perform the optically biaxial film and the 2nd substrate on said substrate using adhesives or a binder lamination and by exfoliating and removing only said substrate by the interface with said optically biaxial film, for example.

[0075] Although it will not be limited especially if it has moderate smoothness as the 2nd substrate used for an imprint, it is transparent and glass, the plastic film which has the optical isotropy are desirable. As an example of this plastic film, films, such as polymethacrylate, polystyrene, a polycarbonate, polyether sulfone, polyphenylene sulfide, polyarylate, amorphous polyolefine, triacetyl cellulose, or an epoxy resin, can be raised. Polymethylmethacrylate, a polycarbonate, polyarylate, triacetyl cellulose, polyether sulfone, etc. are used preferably especially. Moreover, optically, an anisotropy substrate can also be used as the 2nd substrate, when it is a member required for the application made into the purpose. As an example of the 2nd substrate of an anisotropy, such a phase contrast film that extends plastic film, such as a polycarbonate and polystyrene, and is obtained, a polarization film, etc. are mentioned optically.

[0076] Although there will be especially no limit if the adhesives or the binder which sticks the 2nd substrate used for an imprint and an optically biaxial film is the thing of optical grade, things, such as acrylic, an epoxy system, and an urethane system, can be used.

[0077] The approach of said exfoliation can illustrate the approach of exfoliating mechanically, the approach of guessing a supersonic wave and exfoliating in said poor solvent, the approach of giving a temperature change and exfoliating using the difference of the coefficient of thermal expansion of said substrate and said optically biaxial film, etc., after being immersed in the approach of exfoliating mechanically using a roll etc., and the poor solvent to all the stuck ingredients of the structure. Since detachability changes with adhesion of the ingredient used for the optically biaxial film, and said substrate, the approach which was most suitable for the system can be used for it.

[0078] Moreover, although the front face of the obtained 2 shaft film can be used as the optical film of this invention which is a product even if it remains as it is, if needed, a protective layer can be prepared in a front face, adhesion processing can be performed, or it can perform surface treatment, and can also use it as a product.

[0079] What combined said optically biaxial film or said optically biaxial film, and the 2nd substrate can be combined with other films for optics, for example, a phase contrast film, a polarizing plate, etc. which have other refractive-index structures, remaining as it is or if needed, and can be used as the optical film of this invention which is a product. In the formal polarizing plate which protected the ***** polyvinyl alcohol film for the iodine of the format specifically manufactured generally industrially with the two substrates film, said optically biaxial film can be incorporated, and it can unify, and can also consider as the optical film of this invention which is a product.

[0080] The manufacturing method of this invention can manufacture the optical film of this invention with high homogeneity, and since control of refractive-index structure is easy, it can manufacture the optical film with high quality which demonstrates the outstanding function. According to the manufacturing method of this invention, the field of a liquid crystal display can especially manufacture the optical film which can also meet such a demand enough, although the homogeneity of an optical member and the validity of a parameter to be used are evaluated very severely since it is the application of which it complains to vision.

[0081] When the optical film of this invention projects an optical axis on a film plane, the distribution can usually be made into less than **5 times, if the coating edge of a membrane formation ingredient solution is removed. If the approach of extending said both negative optically uniaxial films is adopted using said oriented film as a substrate, distribution of less than **3 times can usually be acquired, and if the homogeneity of extension temperature and the homogeneity of extension tension control on high conditions, **two control is

also possible. If it furthermore limits in the case of uniaxial stretching, and conditions are usually controlled less than **2 times, **1 time and a maximum of **0.5 control can be attained.

[0082] Especially the application of the optical film of this invention can be used as a elliptically-polarized-light plate combined with the phase contrast film and the polarizing plate, although not limited.

[0083] The liquid crystal display of this invention contains the optical film of said this invention.

[0084] Especially the format of the liquid crystal display of this invention is not limited. For example, a STN (SuperTwisted Nematic) cel, TN (Twisted Nematic) cel, VA (Vertical Aligned) cel, An OCB (Optically Controled Birefringence) cel, A HAN (Hybrid Aligned Nematic) cel, And what performed regular orientation division to these, the thing which performed random orientation division, Various kinds of cels shall be included. Moreover, a simple matrix method, The active-matrix method using a TFT (Thin Film Transistor) electrode, an MIM (Metal Insulator Metal) electrode, etc., Various kinds of drive methods which impress driver voltage to the field inboard of a cel, such as an IPS (In-Plane Switching) method and a plasma addressing method, shall be taken. moreover, the thing of the transparency mold equipped with the back light system or the thing of a reflective mold which offered the reflecting plate -- it can also consider as the thing of a projection mold further.

[0085] Although especially a mode equipped with said optical film in the liquid crystal display of this invention is not limited, it is between a polarizing plate and a drive cel, and can usually mention the mode which arranges one sheet or the two or more sheet aforementioned optical film in the location of a drive cel top and/or the bottom. The mode which arranges every one sheet of the film concerned to drive cel a top and the bottom especially is desirable. Furthermore, it can also consider as the mode combined with the phase contrast film which has different refractive-index structure from another film for optics, for example, the optical film of this invention, the dispersion film, the lens sheet, etc.

[0086]

[Effect of the Invention] When the manufacturing method of the optical film of this invention includes the process which obtains a specific negative optically uniaxial film, and the process which extends it, control of refractive-index distribution can manufacture an easy and homogeneous high optical film.

[0087] Since the optical film of this invention is an optical film obtained according to said manufacturing method, it can manufacture easily and refractive-index distribution is correctly controlled by the desired value, and its homogeneity is high and is useful as a phase contrast film, a elliptically-polarized-light plate, etc.

[0088] Since the liquid crystal display of this invention contains the optical film of said this invention, the refractive index of the transmitted light is controlled correctly, it is high and its engine performance is useful as a liquid crystal display which can be manufactured easily.

[0089]

[Example] Although an example is described below, this invention is not limited to these. In addition, each analysis method used in the example is as follows.

(Chemical structure decision) It measured by 400MHz 1 H-NMR (JEOL JNM-GX400).

(Polarization analysis) Ellipsometer by MIZOJIRI OPTICAL Co., Ltd. It carried out using DVA-36VWLD.

(Refractometry) the product made from ATAGO -- it carried out using Abbe refractometer Type-4T.

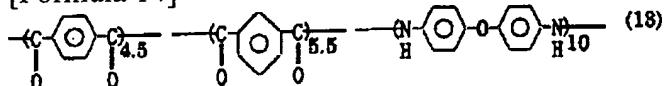
(Thickness measurement) Kosaka Laboratory Make -- highly precise -- thin film level difference measuring instrument ET-10 were mainly used.

[0090] Moreover, the approach of asking for thickness from the data of interference wave measurement (Jasco ultraviolet, visible, and near-infrared spectrophotometer V-570) and a refractive index was also used together.

(Example 1) The polyamide expressed with a formula (13) was compounded as a membrane formation ingredient.

[0091]

[Formula 14]



[0092] The intrinsic viscosity of this polyamide was 1.6 dl/g (30 degrees C, N-methyl-2-pyrrolidone (NMP) solution of 0.5 g/dl). This polyamide was dissolved in NMP and 6% of the weight of the membrane formation ingredient solution was prepared. This membrane formation ingredient solution was used for the polyethylenenaphthalate film (Teijin, Ltd. make) with the thickness of 80 micrometers, a die length [of 30cm], and a width of face of 20cm, the spin coat method was applied, desiccation processing was performed in 80-

degree C oven for 1 hour, and the laminated film was obtained. Several sheets of this laminated film were prepared. Subsequently, uniaxial stretching was carried out by various draw ratio specification which shows each laminated film in Table 1 with constant speed (10 mm/min) in 150-degree C oven. Extension went in the die-length direction of said laminated film. A part of each laminated film after extension was cut down, the polyamide film was exfoliated, these were made into the sample, and refractometry and thickness measurement were performed. A result is shown in Table 1.

[0093]

[Table 1]

試料番号	延伸倍率	膜厚(μm)	ny	nx	nz
1	延伸無し	6.3	1.687	1.687	1.665
2	1.16	5.9	1.707	1.688	1.667
3	1.24	5.8	1.713	1.684	1.664
4	1.32	6.0	1.720	1.682	1.662

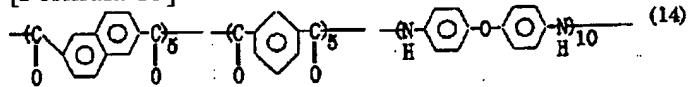
[0094] While the polyamide film (sample number 1) which is not extended from the refractive index of three directions had the negative optically uniaxial structure of $ny=nx>nz$, it turned out that the extended polyamide film (sample numbers 2-4) has the optically biaxial structure of $ny>nx>nz$. The maximum refractive-index direction y was an extended direction here.

[0095] Since the exfoliation polyamide film itself was a thin film and it was lacking in free-standing The imprint to other transparency substrates of the polyamide film was performed using the remaining part which was not used for said measurement of said laminated film. the transparent soda glass plate (1.1mm in thickness) which applied the binder to the front face is prepared, and a binder and the polyamide film touch said laminated film on it -- as -- lamination -- subsequently the polyethylenenaphthalate film was exfoliated. Thus, the laminating glass which equipped the front face with the polyamide film which has optically biaxial refractive-index structure was able to be obtained. When the situation of unevenness was observed on both sides of the obtained laminating glass to the polarizing plate under the cross Nicol's prism of two sheets, it turned out that the film of a uniform polymer is obtained.

(Example 2) The polymer expressed with a formula (14) was compounded as a membrane formation ingredient.

[0096]

[Formula 15]



[0097] The intrinsic viscosity of this polymer was 1.5 dl/g (30 degrees C, NMP solution of 0.5 g/dl). This polymer was dissolved in NMP and the membrane formation ingredient solution of 4 % of the weight of polymer concentration was prepared.

[0098] On the polyethylene terephthalate film with width of face of 40cm, a die length [of 500m], and a thickness of 80 micrometers, the roll coater was used, this membrane formation ingredient solution was applied continuously, desiccation processing was carried out at 100 degrees C, and the laminated film was obtained. It extended by applying the tension of 55Kgf(s) to a longitudinal direction, heating this laminated film at 150 degrees C. The longitudinal direction was contracted 1.09 times and the laminated film after extension had contracted elongation and the cross direction about 0.95 times. The thickness of the polymer layer on the laminated film after extension was 10 micrometers.

[0099] The polyethylene terephthalate film had homogeneous low form birefringence in the field, and since it was not desirable when measuring optical property, the next exfoliation imprint actuation was performed.

[0100] First, ultraviolet curing mold adhesives were applied on the polymer layer on the extended laminated film, and the triacetyl cellulose film (die length 500m, ** of 40cm, the thickness of 80 micrometers, Fuji Photo Film make) was laminated on it. After irradiating ultraviolet rays and stiffening adhesives, polyethylene terephthalate was exfoliated from the polymer layer and the laminated material of a triacetyl cellulose film and a polymer layer was obtained.

[0101] Polarization analysis of the obtained laminated material was carried out. Each angle on which those with two and an optical axis form an optical axis with the normal of laminated material was 38 degrees. Moreover, the direction which projected the optical axis on the field of laminated material was in agreement with the

longitudinal direction of laminated material.

[0102] Moreover, this laminated material was cut down 1m, the retardation within a field was measured every other cm about a longitudinal direction and the cross direction, and distribution was investigated (however, a polymer layer removes 5cm of both ends of the cross direction of the part by which the laminating was carried out). Consequently, it turned out that a retardation value is in the range of 213nm**2nm, and form birefringence can be controlled by less than **1% of precision. Therefore, it turned out that the obtained laminated material is a uniform optically biaxial film.

(Example 3) Using the same membrane formation ingredient solution as an example 2, and the polyethylene terephthalate film, spreading and desiccation were performed similarly and the laminated film was prepared. Horizontal extension was carried out using the tenter, heating this laminated film at 180 degrees C. Lateral tension was set to 0.9Kgf(s) per die length of 1cm, and applied the tension (per [0.07] cm Kgf(s)) of 3Kgf to the longitudinal direction for conveyance. Film width increased about 6% by extension. The polymer layer was imprinted on the triacetyl cellulose film like the example 2 after extension, and the laminated material of a triacetyl cellulose film and a polymer layer was obtained.

[0103] Polarization analysis of the obtained laminated material was carried out. Each angle on which those with two and an optical axis form an optical axis with the normal of laminated material was 24 degrees. Moreover, distribution according [the direction which projected the optical axis on the field of laminated material] to the location within the field of laminated material almost in accordance with the cross direction of laminated material was **1 time. Moreover, distribution of the retardation within a field was less than **2%. Therefore, it turned out that the obtained laminated material is a uniform optically biaxial film.

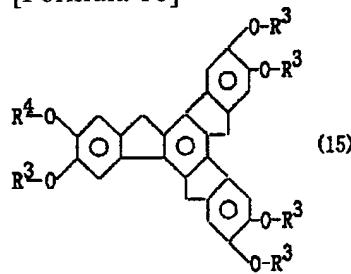
(Example 4) The optical element which unified the polarizing element and optically biaxial film as one of the modes of the optical film of this invention was produced.

[0104] Iodine was infiltrated into the extended polyvinyl alcohol film, this was pasted up on the triacetyl cellulose film using heat-curing mold adhesives, and polyvinyl alcohol-triacetyl cellulose laminated material was obtained. Next, heat-curing mold adhesives were applied on the polymer layer on the laminated material of the triacetyl cellulose film and polymer layer which were obtained in the example 3, lamination and heat were applied the polyvinyl alcohol film side of said polyvinyl alcohol-triacetyl cellulose laminated material, and adhesives were stiffened. In addition, it was made, as for the direction of lamination, for the extension direction of the polyvinyl alcohol film and the roll longitudinal direction of the laminated material of an example 3 to become parallel. Thus, the optical element which has a polarization layer and a birefringence layer between the triacetyl cellulose films of two sheets was producible.

(Example 5) The compound of a formula (15) was compounded.

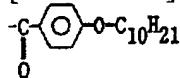
[0105]

[Formula 16]



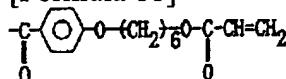
[0106] (The inside R3 of a formula is [0107].)

[Formula 17]



[0108] It comes out, the radical expressed is shown and R4 is [0109].

[Formula 18]

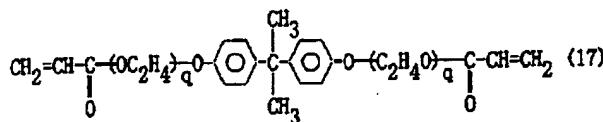
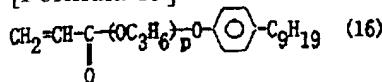


[0110] It comes out and the radical expressed is shown.

Moreover, the compound of a formula (16) and a formula (17) came to hand (respectively Toagosei ARONIKKUSU M-117 and M-2).

[0111]

[Formula 19]



[0112] (The inside p and q of a formula is average polymerization degree, and is about 4 and about 2, respectively.)

these compounds -- compound [of a formula (15)]: -- it mixed by the weight ratio of compound =50:45:5 of a formula (compound:type (17 of 16)), and considered as the start raw material for a polymer film. In addition, although it was the compound which has a disco tic liquid crystal phase if the compound of a formula (15) was independent, said start raw material did not show liquid crystallinity, but was a *** Yuna liquid under the room temperature.

[0113] In addition, photoinitiator IRUGAKYUA 907 (product made from Ciba-Geigy) was used as the membrane formation ingredient constituent to said start raw material 1.5% of the weight. The diethylene-glycol wood ether solvent was added to this, and the solution of 15 % of the weight of membrane formation ingredient constituent concentration was prepared.

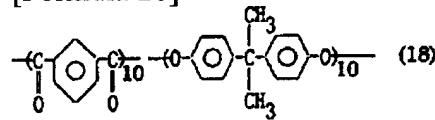
[0114] Having used the spin coat method for the polyphenylene sulfide film (Toray Industries, Inc. make) with the thickness of 50 micrometers, a die length [of 30cm], and a width of face of 20cm, having applied this solution to it, having performed desiccation processing for 10 minutes in 80-degree C oven, and keeping temperature at 60 degrees C further, the high pressure mercury vapor lamp lamp performed UV irradiation to the spreading side, and carried out photo-curing of the membrane formation ingredient constituent, it was made to polymer-ize, and the laminated film which has a polymer layer was obtained. When the refractive index of the polymer layer on the obtained laminated film was measured, it had negative optically uniaxial structure, and the refractive index within a field was fixed and it turned out that the refractive index of 1.59 and the direction of thickness is 1.56.

[0115] Next, uniaxial stretching of said laminated film was increased to the longitudinal direction 1.1 times with constant speed (10 mm/min) in 200-degree C oven. The refractive indexes of the film after extension were $ny=1.61$, $nx=1.58$, and $nz=1.56$. The polymer layer on the obtained laminated film was imprinted to up to the glass substrate like the example 1. It observed under polarization, consequently it turned out that the polymer layer on a glass substrate has uniform homogeneous optically biaxial structure.

(Example 6) The polymer expressed with a formula (18) was compounded as a membrane formation ingredient.

[0116]

[Formula 20]



[0117] The intrinsic viscosity of this polymer was 0.65 dl/g (30 degrees C, NMP solution of 0.5 g/dl). Dissolved this membrane formation ingredient in NMP, prepared 4% of the weight of the membrane formation ingredient solution, applied to the aluminum plate of 20cm angle, it was made to dry in 80-degree C oven, and the laminate was obtained. The thickness of the polymer layer on this laminate was 45 micrometers. Subsequently, the polymer layer was carefully removed from the aluminum plate, the polymer film was obtained, and this was extended 1.05 times at 140 degrees C. The polymer film after extension was transparent and had optically biaxial. It was 100nm when asked for the retardation which is the product of ($n_x - n_z$) and thickness in polarization analysis. Moreover, the retardation within the field which are ($n_y - n_z$) and thickness was about 390nm. When the projection direction to the field of the polymer film of an optical axis was investigated about the range of 10cm angle of a polymer film core, there was **four distribution centering on the extension

direction of the polymer film. Moreover, distribution of the retardation within a field was 390nm**18nm.

[Translation done.]

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3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The manufacturing method of the optical film characterized by including the process which was allotted and dried on the substrate and carried out plane orientation of the membrane formation ingredient solution, and which obtains a negative optically uniaxial film optically, and the process which extends said negative optically uniaxial film and is used as an optically biaxial film.

[Claim 2] The manufacturing method of the optical film according to claim 1 characterized by said substrate being an oriented film.

[Claim 3] The manufacturing method of the optical film according to claim 2 characterized by extending in the process which extends said negative optically uniaxial film, heating said negative optically uniaxial film with said oriented film.

[Claim 4] The optical film obtained according to the manufacturing method of claim 1-3 given in any 1 term.

[Claim 5] The optical film according to claim 4 characterized by distribution of the projection direction to the film plane of a film optical axis being less than **2 degrees.

[Claim 6] The liquid crystal display component characterized by including an optical film according to claim 4 or 5.

[Translation done.]

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